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**SHORT COMMUNICATION in MYCOLOGY**

# First Record of Slime Molds in Biebrza National Park (NE Poland)

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**Abstract**

This paper provides the first recorded data of slime molds in Biebrza National Park (NE Poland). In total, 16 species of myxomycetes belonging to nine genera were observed.

**Keywords**

myxomycetes; ecology; protected area; NE Poland

## 1. Introduction

Myxomycetes are a small group of eukaryotic organisms that includes approximately 1,000 species worldwide. They are characterized by a complex life cycle that is distinguished by the presence of a plasmodium stage and the formation of sporocarps (Baba & Sevindik, 2018; Lado, 2005–2021; Stephenson & Rojas, 2017). Poland has approximately 250 species of myxomycetes (Drozdowicz et al., 2003), the information on which remains fragmented. However, slime molds have been studied in several national parks (Drozdowicz, 1997, 2004, 2009, 2014; Komorowska & Drozdowicz, 1996; Magiera & Drozdowicz, 2004; Narkiewicz et al., 2013; Panek & Romański, 2010; Salamaga et al., 2016).

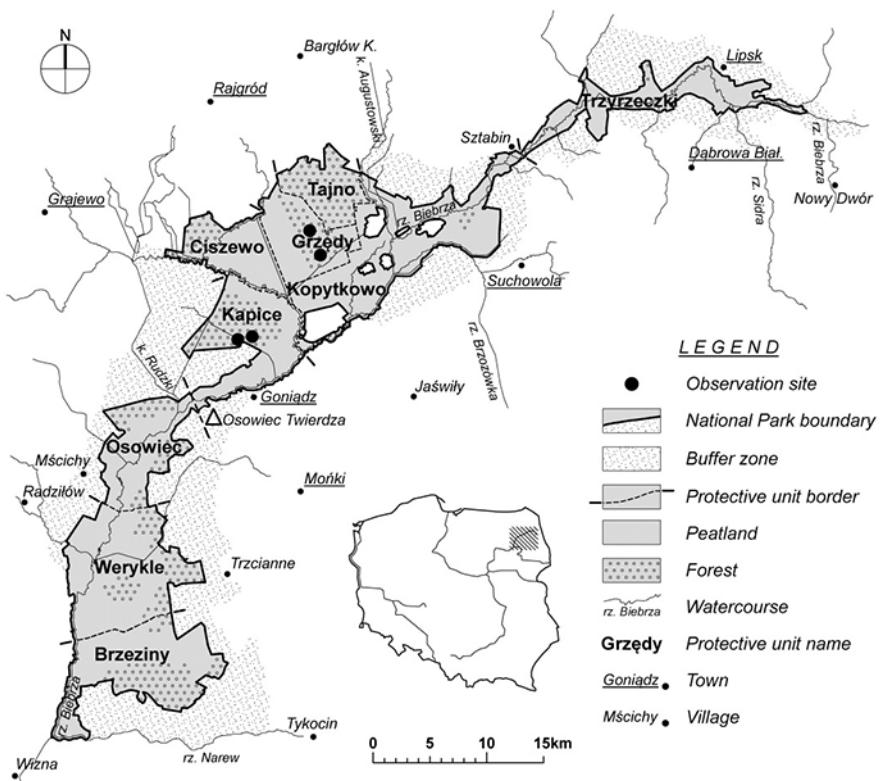
The ecology of northeast (NE) Poland is rich and varied, with many species of plants, animals, and fungi. They are protected in four national parks: Białowieża National Park, Narew National Park, Biebrza National Park (BbNP), and Wigry National Park.

BbNP was established in 1993; it is the largest national park in Poland, covering 59.223 ha with a 66.824 ha buffer zone. The park is unique within Europe in that it encompasses an entire river valley, from its sources to its mouth.

The river valley itself comprises a number of habitats preserved in an almost unchanged state, organized according to natural longitudinal and transversal zones with their corresponding plant communities as well as a large complex of fens. Some of the most predominant habitats in Biebrza Valley are peatlands with swamp forests comprised mainly of alder and birch (Dyracz & Werpacowski, 2005).

The first data on slime molds in the NE Poland region were presented by Krzemieniewska (1957, 1960). The samples were collected from the Białowieża Forest as part of a project for obtaining herbarium materials (i.e., myxomycetes) from different regions in Poland. Then, Drozdowicz (2014) conducted research there, where she assigned 103 species of slime molds. A field study by Panek and Romański (2010) in Wigry National Park (NE Poland) yielded an interesting and rich collection of slime molds, including seven species new to the country.

The present data on BbNP were obtained as part of a mycological study undertaken by members of the Polish Mycological Society. The results of the mycological study were previously presented by Kujawa et al. (2012, 2015) and Ruszkiewicz-Michalska et al. (2012, 2015).



**Figure 1** Localization on observation sites in the Biebrza National Park (according to Kujawa et al., 2012, modified).

## 2. Material and Methods

The study was carried out in the central area of BbNP (Figure 1) from August 28 to September 1, 2012, and from August 24 to August 29, 2013. The collections of slime molds were primarily acquired from two protected areas: Grzędy and Kapice. *Tilio-Carpinetum* forest associations were identified within these sites.

The multispecies stand included *Carpinus betulus*, *Tilia cordata*, *Acer platanoides*, and *Betula pendula*. The field layer was composed of *Anemone nemorosa*, *Stellaria holostea*, *Galeobdolon luteum*, *Aegopodium podagraria*, *Asarum europaeum*, *Pulmonaria obscura*, and *Lilium martagon* (Dyracz & Werbachowski, 2005).

Macromorphological and micromorphological analyses were performed.

The specimens were observed with a NIKON SMZ-10 binocular microscope and a NIKON Eclipse E-200 light microscope. The identification of species was carried out according to specialist literature, e.g., Neubert, Nowotny, and Baumann (1993), Neubert, Nowotny, Baumann, and Marx (1995, 2000), Ing (1999), and Nannenga-Bremekamp (1991). The nomenclature followed those accepted by Lado (2005–2021). The specimens documented in the study were preserved at the Fungal Collection of the Herbarium Universitatis Lodzienensis.

## 3. List of Species

A total of 16 species belonging to nine genera were identified. This investigation broadly contributes to research in this area by providing the first recorded list of taxa in the BbNP. These results show that even short-term investigations in areas of unique natural value can contribute to the development of knowledge on the diversity and distribution of slime mold species in Poland.

*Arcyria cinerea* (Bull.) Pers., on decaying fallen twigs, Kapice district, 2012-08-28; leg. & det. DS

*A. denudata* (L.) Wettst., on logs, Kapice and Grzedy districts, 2012-08-28–2012-08-29, leg. & det. DŚ

*Ceratiomyxa fruticulosa* (O. F. Müll.) T. Macbr., on a strongly decayed trunk, Grzedy district, 2013-08-27, leg. M. Ruszkiewicz-Michalska, det. DŚ

*Diachea leucopodia* (Bull.) Rostaf., on fallen small twigs, Kapice district, 2012-08-28, leg. & det. DŚ

*Fuligo leviderma* H. Neubert, Nowotny & K. Baumann, on fallen branches of *Betula* sp., Kapice district, 2012-08-28, leg. & det. DŚ

*F. luteonitens* L. G. Krieglst. & Nowotny, on fallen branches of *Betula* sp., Grzedy district, 2013-08-27, leg. J. Szkodzik, det. DŚ

*Hemitrichia serpula* (Scop.) Rostaf. ex Lister, on decaying trunks, Grzedy district, 2012-08-29, leg. M. Wrzosek, det. DŚ

*Lycogala conicum* Pers., on decaying wood, Kapice district, 2012-08-28, leg. & det. DŚ

*L. epidendrum* (L.) Fr., on coniferous wood, Kapice district, 2012-08-28, leg. J. Szkodzik, det. DŚ

*Metatrichia vesparia* (Batsch) Nann.-Bremek. ex G. W. Martin & Alexop., on strongly decayed wood of deciduous tree, Kapice district, 2012-08-28, leg. & det. DŚ

*Mucilago crustacea* P. Micheli ex F. H. Wigg., stem of *Convallaria majalis*, Kapice district, 2012-08-28, leg., M. Wrzosek, det. DŚ

*Physarum bivalve* Pers., on fallen leaves, Grzedy district, 2013-08-27, leg. J. Szkodzik, det. DŚ

*Stemonitis fusca* Roth, on coniferous wood, Grzedy district, 2012-08-29, leg. & det. DŚ

*S. pallida* Wingate, on deciduous wood, Grzedy district, 2012-08-29, leg. & det. DŚ

*Trichia favoginea* (Batsch) Pers., on fallen branches, Kapice district, 2012-08-28, leg. & det. DŚ; Grzedy district, 2013-08-27, leg. J. Szkodzik, det. DŚ

*Tubifera ferruginosa* (Batsch) J. F. Gmel., on decayed wood, Grzedy district, 2013-08-27, leg. M. Ruszkiewicz-Michalska, det. DŚ

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### References

Baba, H., & Sevindik, M. (2018). The roles of myxomycetes in ecosystems. *Journal of Bacteriology & Mycology: Open Access*, 6(3), 165–166. <https://doi.org/10.15406/jbmoa.2018.06.00197>

Drozdowicz, A. (1997). Studies on myxomycetes in the Pieniny National Park. I. New species for the PNP. *Acta Mycologica*, 32(2), 287–291. <https://doi.org/10.5586/am.1997.025>

Drozdowicz, A. (2004). Materiały do chorologii śluzowców w Bieszczadzkim Parku Narodowym [Materials for myxomycetes chorology in the Bieszczady National Park]. *Roczniki Bieszczadzkie*, 13, 261–276.

Drozdowicz, A. (2009). Śluzowce [Myxomycetes]. In A. Górecki, & B. Zemanek (Eds.), *Magurski Park Narodowy. Monografia Przyrodnicza* [Magura National Park] (pp. 91–96). Magurski Park Narodowy; Uniwersytet Jagielloński.

Drozdowicz, A. (2014). *Myxomycetes of the Białowieża Forest*. Białowieski Park Narodowy.

Drozdowicz, A., Ronikier, A., Stojanowska, W., & Panek, E. (2003). *Myxomycetes of Poland – A checklist*. W. Szafer Institute of Botany, Polish Academy of Sciences.

Dyracz, A., & Werpachowski, C. (2005). *Przyroda Biebrzańskiego Parku Narodowego. Monografia* [Nature of the Biebrza National Park. A monograph]. Biebrzański Park Narodowy.

Ing, B. (1999). *The myxomycetes of Britain and Ireland. An identification Book.* The Richmond Publishing.

Komorowska, H., & Drozdowicz, A. (1996). Śluzowce [Slime molds]. In Z. Mirek (Ed.), *Przyroda Tatrzańskiego Parku Narodowego* [The nature of the Tatra National Park] (pp. 405–412). Tatrzanski Park Narodowy.

Krzemieniewska, H. (1957). Spis śluzowców zebranych w latach 1955–1956 [List of slime molds collected in 1955–1956]. *Acta Societatis Botanicorum Poloniae*, 26(4), 785–811. <https://doi.org/10.5586/asbp.1957.041>

Krzemieniewska, H. (1960). *Śluzowce Polski na tle flory śluzowców europejskich* [Polish slime molds against the background of European slime mold flora]. PWN.

Kujawa, A., Gierczyk, B., Domian, G., Wrzosek, M., Stasińska, M., Szkodzik, J., Leski, T., Karliński, L., Pietras, M., Dynowska, M., Henel, A., Ślusarczyk, D., & Kubiak, D. (2015). Preliminary studies of fungi in the Biebrza National Park. Part IV. Macromycetes – New data and the synthesis. *Acta Mycologica*, 50(2), Article 1070. <https://doi.org/10.5586/am.1070>

Kujawa, A., Wrzosek, M., Domian, G., Kędra, K., Szkodzik, J., Rudawska, M., Leski, T., Karliński, L., Pietras, M., Gierczyk, B., Dynowska, M., Ślusarczyk, D., Kałucka, I., & Ławrynowicz, M. (2012). Preliminary studies of fungi in the Biebrza National Park. II. Macromycetes. *Acta Mycologica*, 47(2), 235–264. <https://doi.org/10.5586/am.2012.026>

Lado, C. (2005–2021). *An on-line nomenclatural information system of Eumycetozoa.* Retrieved September 25, 2020, from <https://eumycetozoa.com/>

Magiera, A., & Drozdowicz, A. (2004). Śluzowce (myxomycetes) Babiogórskiego Parku Narodowego [Slime molds of the Babia Góra National Park]. In B. W. Wołoszyn, A. Jaworski, & J. Szwagrzyk (Eds.), *Babiogórski Park Narodowy. Monografia przyrodnicza* [Babia Góra National Park. Nature monograph] (pp. 315–332). W. Szafer Institute of Botany, Polish Academy of Sciences.

Nannenga-Bremekamp, N. E. (1991). *A guide to temperate myxomycetes.* Biopress.

Narkiewicz, C., Pusz, W., Kita, W., & Panek, E. (2013). Grzyby i śluzowce [Fungi and slime molds]. In P. Knapik, R. Migoń, & A. Raj (Eds.), *Przyroda Karkonoskiego Parku Narodowego* [Nature of the Karkonosze National Park] (pp. 339–358). Karkonoski Park Narodowy.

Neubert, H., Nowotny, W., & Baumann, K. (1993). *Die Myxomyceten Deutschlands und des angrenzenden Alpenraumes unter besonderer Berücksichtigung Österreichs* [Myxomycetes in Germany and the Alpine region with special focus on Austria] (Vol. 1). Karlheinz Baumann Verlag.

Neubert, H., Nowotny, W., Baumann, K., & Marx, H. (1995). *Die Myxomyceten Deutschlands und des angrenzenden Alpenraumes unter besonderer Berücksichtigung Österreichs* [Myxomycetes in Germany and the Alpine region with special focus on Austria] (Vol. 2). Karlheinz Baumann Verlag.

Neubert, H., Nowotny, W., Baumann, K., & Marx, H. (2000). *Die Myxomyceten Deutschlands und des angrenzenden Alpenraumes unter besonderer Berücksichtigung Österreichs* [Myxomycetes in Germany and the Alpine region with special focus on Austria] (Vol. 3). Karlheinz Baumann Verlag.

Panek, E., & Romański, M. (2010). Śluzowce Myxomycetes [Slime molds]. In L. Krzysztofiak (Ed.), *Śluzowce Myxomycetes, grzyby Fungi i mszaki Bryophyta Wigierskiego Parku Narodowego* [Slime molds, Fungi and Bryophytes of the Wigry National Park] (pp. 9–84). Stowarzyszenie “Człowiek i Przyroda”.

Ruszkiewicz-Michalska, M., Bałazy, S., Chełkowski, J., Dynowska, M., Pawłowska, J., & Sucharzewska, E. (2015). Preliminary studies of fungi in the Biebrza National Park (NE Poland). Part III. Micromycetes – New data. *Acta Mycologica*, 50(2), Article 1067. <https://doi.org/10.5586/am.1067>

Ruszkiewicz-Michalska, M., Tkaczuk, C., Dynowska, M., Sucharzewska, E., Szkodzik, J., & Wrzosek, M. (2012). Preliminary studies of fungi in the Biebrza National Park (NE Poland). I. Micromycetes. *Acta Mycologica*, 47(2), 213–234. <https://doi.org/10.5586/am.2012.026>

Salamaga, A., Grzesiak, B., Wolski, G. J., Kochanowska, M., & Kochanowski, J. (2016). Preliminary investigations into the slime moulds (Myxogastria) in the “Bory Tucholskie” National Park. *Acta Mycologica*, 51(1), Article 1077. <https://doi.org/10.5586/am.1077>

Stephenson, S. L., & Rojas, C. (2017). Introduction. In S. L. Stephenson, & C. Rojas (Eds.), *Myxomycetes: Biology, systematics, biogeography, and ecology* (pp. 17–20). Academic Press. <https://doi.org/10.1016/B978-0-12-805089-7.00017-2>